

## IN THE CLAIMS

What is claimed is:

- 1 1. A computer software product including one or more recordable media having  
2 executable instructions stored thereon which, when executed by a processing  
3 device, causes the processing device to:  
4 strengthen a first antecedent label for an edge in an assertion graph.
- 1 2. The computer software product recited in Claim 1 which, when executed by a  
2 processing device, further causes the processing device to:  
3 abstract a second antecedent label to produce the first antecedent label.
- 1 3. The computer software product recited in Claim 1 wherein strengthening the  
2 antecedent label comprises causing the processing device to:  
3 join any pre-images for antecedent labels of outgoing edges from the  
4 edge in the assertion graph; and  
5 keep in the strengthened antecedent label for the edge only what is  
6 already contained by the first antecedent label for the edge and also  
7 contained by the joined pre-images for antecedent labels of outgoing edges  
8 from the edge.
- 1 4. The computer software product recited in Claim 1 which, when executed by a  
2 processing device, further causes the processing device to:  
3 compute a simulation relation for the edge from the strengthened  
4 antecedent label; and  
5 compare the simulation relation for the edge to a consequence label for  
6 the edge.
- 1 5. The computer software product recited in Claim 4 wherein computing the  
2 simulation relation comprises causing the processing device to:

3 identify in the strengthened antecedent label of the edge any states that  
4 are also contained by a post-image for a simulation relation of an edge  
5 incoming to the edge in the assertion graph; and  
6 join to the simulation relation for the edge, the identified states.

1 6. The computer software product recited in Claim 4 wherein comparing the  
2 simulation relation to a consequence label comprises causing the processing  
3 device to:

4 determine whether the simulation relation for the edge is contained by the  
5 consequence label for the edge.

1 7. The computer software product recited in Claim 4 wherein comparing the  
2 simulation relation to a consequence label comprises causing the processing  
3 device to:

4 negate a Boolean expression of the simulation relation for the edge, and:  
5 logically combine the negated Boolean expression with a Boolean  
6 expression of the consequence label for the edge using a logical OR  
7 operation.

1 8. The computer software product recited in Claim 4 wherein computing a  
2 simulation relation for the edge from the strengthened antecedent label  
3 comprises causing the processing device to:

4 compute a simulation relation abstraction for the edge; and  
5 concretize the simulation relation abstraction for the edge to produce the  
6 simulation relation for the edge.

1 9. The computer software product recited in Claim 8 wherein computing a  
2 simulation relation for the edge from the strengthened antecedent label  
3 further comprises causing the processing device to:

4 abstract the strengthened antecedent label to produce an antecedent

5 label abstraction for the edge; and

6 use the antecedent label abstraction to compute the simulation relation

7 abstraction for the edge.

1 10. A method comprising:

2 strengthening a first antecedent label for an edge in an assertion graph;

1 11. The method recited in Claim 10 wherein strengthening the antecedent label

2 comprises:

3 joining pre-images of antecedent labels of any outgoing edges from the

4 edge in the assertion graph; and

5 keeping, in the strengthened antecedent label for the edge, states already

6 contained by the first antecedent label for the edge and also contained by the

7 joined pre-images of antecedent labels of any outgoing edges from the edge.

1 12. The method recited in Claim 10 wherein the first antecedent label is one of a

2 plurality of antecedent labels including a second antecedent label encoded

3 along with the first antecedent label into a third antecedent label by a

4 symbolic indexing function.

1 13. The method recited in Claim 10 further comprising:

2 computing a simulation relation for the edge from the strengthened

3 antecedent label; and

4 comparing the simulation relation for the edge to a consequence label for

5 the edge.

1 14. The method recited in Claim 13 wherein comparing the simulation relation to

2 a consequence label comprises:

3 determining whether the simulation relation for the edge is contained by

4 the consequence label for the edge.

1 15. The method recited in Claim 13 wherein comparing the simulation relation to  
2 a consequence label comprises:

3 negating a Boolean expression of the simulation relation for the edge,  
4 and:

5 logically combining the negated Boolean expression with a Boolean  
6 expression of the consequence label for the edge using a logical OR  
7 operation.

1 16. A method comprising:

2 computing a first simulation relation for an edge in a first assertion graph  
3 from a first antecedent label for the edge;

4 computing a second simulation relation for the edge from a concretization  
5 function applied to the first simulation relation for the edge; and

6 comparing the second simulation relation for the edge with a  
7 consequence label for a corresponding edge in a second assertion graph to  
8 see if the second simulation relation is contained by the consequence label.

1 17. The method recited in Claim 16 further comprising:

2 computing the first antecedent label as an abstraction of a second  
3 antecedent label for the corresponding edge in the second assertion graph.

1 18. The method recited in Claim 17 further comprising:

2 computing the second antecedent label by strengthening a third  
3 antecedent label for the edge in the second assertion graph.

1 19. The method recited in Claim 16 further comprising:

2 computing a third antecedent label for the edge in the first assertion graph  
3 as an abstraction of a second antecedent label for the corresponding edge in  
4 the second assertion graph; and

5           computing the first antecedent label by strengthening the third antecedent  
6           label for the edge in the first assertion graph.

1   20. A verification system comprising:

2           means for strengthening an first antecedent label for an edge in an  
3           assertion graph;

1   21. The verification system of Claim 20 wherein the means for strengthening the  
2           antecedent label comprises:

3           means for joining any pre-images for antecedent labels of outgoing edges  
4           from the edge in the assertion graph; and

5           means for keeping, in the strengthened antecedent label for the edge,  
6           states already contained by the first antecedent label for the edge and also  
7           contained by the joined pre-images for antecedent labels of outgoing edges  
8           from the edge.

1   22. The verification system of Claim 20 wherein the first antecedent label is one  
2           of a plurality of antecedent labels including a second antecedent label  
3           encoded along with the first antecedent label into a third antecedent label by  
4           a symbolic indexing function.

1   23. The verification system of Claim 20 further comprising:

2           means for computing a simulation relation for the edge from the  
3           strengthened antecedent label; and

4           means for comparing the second simulation relation for the edge with a  
5           consequence label for a corresponding edge in a second assertion graph to  
6           check if the second simulation relation is contained by the consequence  
7           label.

1   24. The verification system of Claim 23 wherein the means for comparing the  
2           simulation relation to a consequence label comprises:

3 means for determining whether the simulation relation for the edge is  
4 contained by the consequence label for the edge.

1 25. A verification system comprising:

2 means for computing a first simulation relation for an edge in a first  
3 assertion graph from a first antecedent label for the edge;  
4 means for computing a second simulation relation for the edge from a  
5 concretization function applied to the first simulation relation for the edge; and  
6 means for comparing the second simulation relation for the edge with a  
7 consequence label for a corresponding edge in a second assertion graph to  
8 see if the second simulation relation is contained by the consequence label.

1 26. The verification system of Claim 26 further comprising:

2 means for computing the first antecedent label as an abstraction of a  
3 second antecedent label for the corresponding edge in the second assertion  
4 graph.

1 27. The verification system of Claim 27 further comprising:

2 means for computing the second antecedent label by strengthening a  
3 third antecedent label for the edge in the second assertion graph.

1 28. The verification system of Claim 26 further comprising:

2 means for computing a third antecedent label for the edge in the first  
3 assertion graph as an abstraction of a second antecedent label for the  
4 corresponding edge in the second assertion graph; and  
5 means for computing the first antecedent label by strengthening the third  
6 antecedent label for the edge in the first assertion graph.

1 29. A verification system comprising:

2 a recordable medium to store executable instructions;  
3 a processing device to execute instructions; and

4 a plurality of executable instructions that when executed by the processing  
5 device, cause the processing device to strengthen a antecedent label for an  
6 edge in an assertion graph.

1 30. The verification system of Claim 4 wherein the plurality of executable  
2 instructions, when executed by the processing device, further cause the  
3 processing device to:  
4 compute a first simulation relation for the edge; and  
5 concretize the first simulation relation computed for the edge to produce a  
6 second simulation relation for the edge.